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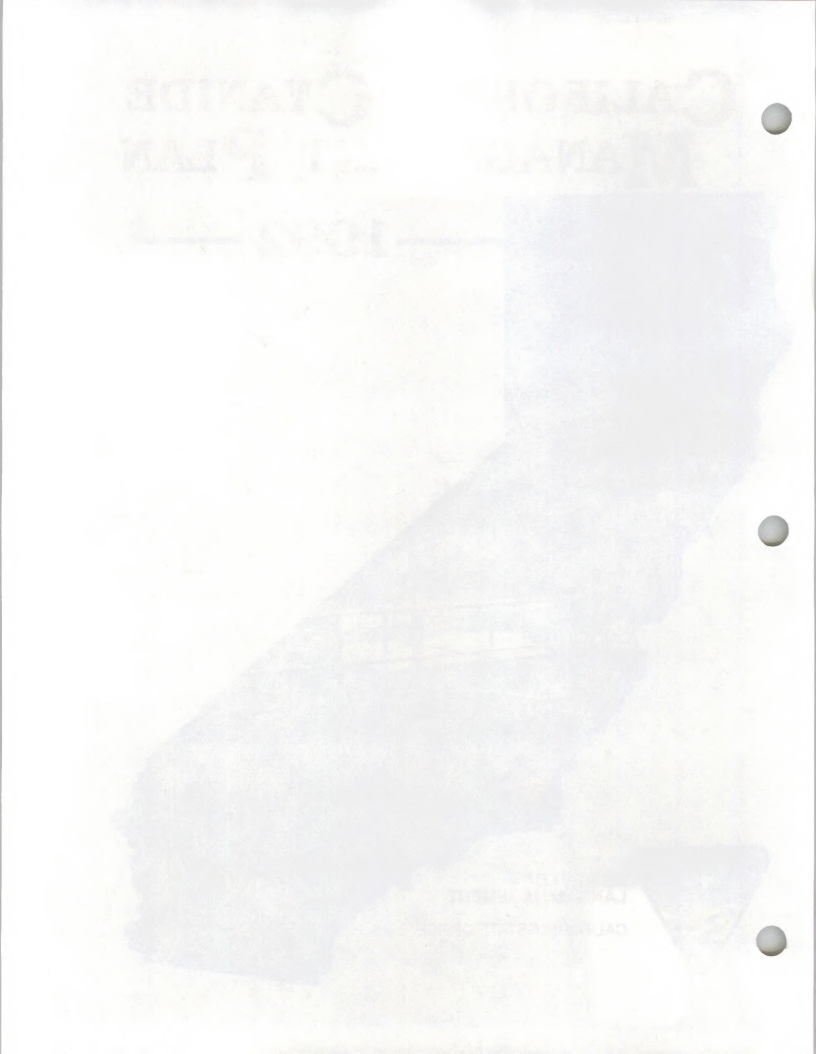

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U. S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

DIVISION OF MINERAL RESOURCES

CALIFORNIA CYANIDE MANAGEMENT PLAN

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MAY 14 1992
Date

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

CALIFORNIA CYANIDE MANAGEMENT PLAN

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BUREAU OF LAND MANAGEMENT

CALIFORNIA CYANIDE MANAGEMENT PLAN

I. INTRODUCTION

The BLM's national cyanide management policy requires the BLM States to prepare a Cyanide Management Plan. This Plan will be applied to BLM lands in California and administered by the BLM California State Office.

A. Plan Objectives

The objectives of the Cyanide Management Plan are to:

1. Implement the BLM's national cyanide management policy;

2. Ensure that mining operations using cyanide on BLM managed lands follow best management practices and do not cause unnecessary or undue degradation of the federal lands;

3. Provide both the mine operator and the BLM technical staff with standards for development and evaluation of mining projects that use cyanide;

4. Use State Standards, if established.

B. Plan Scope

This plan focuses on cyanide use in mining activities. General administration, operation, and reclamation practices common to all mining operations are not addressed in this plan, but can be found in other Bureau program guidance.

This effort represents the first step in the management of cyanide and other leachates on the public lands in California. Additional standards and periodic updates will follow as needs are identified.

The Cyanide Management Plan is not a set of new regulations and should not be used or interpreted as such. Where performance requirements are put forward these are considered the general standards needed to prevent unnecessary or undue degradation. The standards may be modified during review of individual mining proposals to allow for site specific operating constraints, environmental conditions, and the degree of risk involved.

This Plan does not duplicate requirements of other federal or state agencies with responsibility to the use of cyanide in mining operations. The goal of this Plan is to reference and use existing federal and state standards. Accordingly, where standards are established for mining operations by California Regional Water Quality Control Boards, such standards shall apply when reviewing a notice or plan of operations.

In California, the Regional Water Quality Control Boards (RWQCB) regulate miners under Article 7 of Chapter 15 of Division 3 of Title 23 of the California Code of Regulations (Chapter 15). The primary purpose of these regulations is to carry out the statutory mandate of the Porter-Cologne Water Quality Act (Water Code) which is to protect the beneficial uses of the waters of the state for the people of California. Chapter 15 regulates the discharges of waste to land under a non-degradation policy (Resolution 68-16). Dischargers are required to assess the physical and chemical characteristics of mining waste for purposes of classification, comply with minimum prescriptive standards when constructing waste management units for waste of a particular classification, monitor the units and water of the state to ensure that the units are not leaking, and maintain the closed units to ensure that waters of the State are protected from degradation.

Without proper standards mines employing cyanide extraction technology have the potential to threaten the water of the State. Regional Boards are responsible for classifying such mining waste (including spent heap leach ore), specifying containment for mining waste management units including active close-in-place heap leach pads, and specifying monitoring requirements including heap leach detoxification. There are nine Regional Boards which issue waste discharge requirements that specify the foregoing permit conditions for a specific mine after the proponent has submitted a report of waste discharge presenting the technical aspects of the proposed project. Dischargers then must either abide by the conditions of their waste discharge requirements or face a variety of penalties including fines or, in extreme cases, cease and desist orders.

C. Existing Operations

Existing operations are subject to this plan with the following exceptions:

1. Operations which have had no solution containment difficulties are not subject to the storm event containment criteria unless the Authorized Officer specifically determines existing facilities are inadequate;

2. Operations which have not experienced avian mortalities will not be required to net existing exposed solution containment structures;

3. Existing facilities including heaps, mills, ponds, and tailings impoundments are exempt from criteria which would require reconstruction unless such facilities are causing unnecessary or undue degradation.

As operating plans are modified at existing mines any new cyanide facilities would be subject to all aspects of this cyanide management plan.

II. PROGRAM STATUS

A. Activity

In California there are eleven (11) operations that utilize cyanide on BLM managed lands as of January 1992. These vary from small operations up to some of the largest gold mines in the state. There are also many expansion and exploration projects underway that could eventually use cyanide upon development.

B. Regulatory Authority

The majority of cyanide operations occur in the BLM's California Desert District. However, gold mines do occur in all four Districts. Project review, inspection, and enforcement is performed by Resource Area personnel, with program oversight by the District Office and State Office in Sacramento.

Cyanide operations in California are managed in cooperation with the counties in accordance with California Environmental Quality Act (CEQA) and Surface Mining and Reclamation Act (SMARA) per a general Memorandum of Understanding (MOU). The California Division of Mines and Geology (CDMG) is the oversight agency for the SMARA program which is implemented by local enforcement agencies (LEAs), usually counties.

Regulatory interaction occurs between BLM, SMARA, RWQCB, and on occasion, the Environmental Protection Agency (EPA). Technical information exchanges also include the U.S. Forest Service, the U.S. Bureau of Mines, Mine Safety and Health Administration (MSHA), and the California Division of Mines and Geology.

The BLM has surface protection responsibilities for mining activities on Indian lands. These are conducted in cooperation with the Bureau of Indian Affairs and the local tribal government. Currently there are no cyanide operations on Indian lands. Should any develop this plan would guide their evaluation.

III. GUIDANCE

The following guidance and authorities have been used to prepare this plan:

Federal Land Policy and Management Act (FLPMA); PL 94-579, Sections 302(b). FLPMA directs that in managing the public lands the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands from activities authorized by the mining laws.

National Environmental Policy Act (NEPA), PL 91-190. Requires environmental analysis (EA or EIS) of federal actions, specifically Plan of Operations approval.

Migratory Bird Treaty Act (MBTA); 16 USC 701 et seq. Prohibits the taking of migratory birds. Applies to indiscriminate killing of migratory birds in cyanide process ponds.

Resource Conservation and Recovery Act of 1976 (RCRA); 42 USC 6901 et seq. Regulates solid and hazardous wastes disposal.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended; 42 USC 9615. Directs response and clean-up actions at sites where hazardous substances have been released. Also requires notification when extremely hazardous substances are used onsite. (SARA - Community right to know.)

Safe Drinking Water Act; PL 93-523, Dec. 1974. Established to protect groundwater and drinking water sources. Set primary standards with maximum containment levels (MCL) and secondary standards.

Water Quality Act of 1987; 33 USC 1251. Controls point and nonpoint sources of pollution.

BLM Regulations 43 CFR 3809; Surface Management Under the General Mining Laws. Requires mining operators to file a Notice or Plan of Operations for mining activities on BLM administered land.

BIA Regulation 25 CFR 216; Surface Exploration, Mining, and Reclamation of Lands. Requires operators on Indian lands to file a mining plan with the Mining Supervisor of the U. S. Geological Survey and obtain his approval. This duty was transferred from the USGS to the BLM during the 1982 merger.

BLM Manual 3809; Surface Management. Provides general BLM guidance for administration of mining operations on BLM administered lands.

BLM Regulation 43 CFR 3802; Surface Management Under the General Mining Laws in Wilderness Study Areas.

Memorandum of Understanding between BLM and SMARA, 1990. Provides for a joint Federal/State regulatory program of mining activity on BLM lands in California.

WO IM No. 90-566 (8/6/90); Policy for Surface Management of Mining Operations Utilizing Cyanide or other Leaching Techniques. Directs preparation of cyanide management plans and minimum requirements for each state administrative unit.

WO IM No. 90-534, Change 1, (10/9/90); Interim Policy for Entry onto Hazardous Waste Sites. Provides for BLM personnel to enter cyanide operations when within the scope of their job duties.

WO IM No. 90-582, (8/14/90); Bonding Policy for Cyanide Operations. Requires 100% reclamation bonding for cyanide facilities associated with Plan of Operations.

IV. CYANIDE OPERATIONS REVIEW AND PERFORMANCE STANDARDS

The BLM will use an interdisciplinary approach in the review of Notices and approval of Plan of Operations. Individuals with expertise in the physical and biological sciences will be used in the evaluation of cyanide mining operations.

The following are the standards that will be applied when reviewing Notices or approving a Plan of Operations involving cyanide. Detailed technical information may be found in pertinent scientific and engineering references (a partial list is in Section XIV).

A. General

The biological conditions must be fully described to identify plant or animal species in the mine area that may be affected.

The hydrology must be fully described to identify any industrial, domestic or agricultural water use adjacent the mine area that may be affected.

The hydrologic regime at the mine site must be fully described to characterize climatic conditions and storm event intensity and duration. Extrapolation of data from the nearest weather station combined with available baseline information may be necessary.

Cyanide facility foundation material and groundwater conditions must be fully described.

A stability analysis of leaching facilities and impoundments are required.

Areas suitable for land application disposal of treated process solutions will be identified and tested for disposal capacity. The area is to be adequate for final disposal of residual process solutions at the end of mine life and for emergency use.

Leak detection and recovery systems must be designed for heaps, tailings impoundments, and solution containment structures. Leak detection and recovery systems include direct detection systems designed and built into the facility and/or monitoring system located immediately adjacent the facility. The leak detection system should be in compliance with RWQCB requirements.

B. Geotechnical

Engineering designs, maps, and cross-sections of the diversion structures and cyanide facilities are to be included in a Notice or Plan of Operations submitted to BLM. The operator may be required to provide independent verification by a registered, professional engineer that the facilities have been constructed according to the approved design plan and specifications.

A description of the quality control and quality assurance programs that will be used during construction of the facility is required.

The following standards will be used by BLM when evaluating specific cyanide operation components:

1. Leach Pads

Leach pads must meet the following minimum requirements:

a) Containment of process fluids must consist of an engineered liner system which provides containment equal to or greater than that provided by a synthetic liner placed on top of a prepared subbase of 12 inches of soil, which has a maximum recompacted in place coefficient of permeability of $1x10^{-6}$ cm/sec or of $1x10^{-5}$ cm/sec when combined with a system for the detection of leaks which must be located at least beneath those portions of the liner which have the greatest potential for leakage. The potential for leakage must be determined by the extent the hydraulic head exerted on a portion of the liner and the period of time a portion of the liner is exposed to process fluids.

b) A leak detection system is necessary.

c) Diversion structures must be placed to preclude surface runoff from entering the leach pad during operations. A minimum 100-year, 24-hour storm event design criteria will be used for diversion ditches.

d) Groundwater interception structures (french drains, finger drains, geotextiles, etc.) should be considered beneath the leach pad in areas with high, or perched water tables or springs.

e) The amount of hydraulic head on leach pad liners will be minimized. Valley-fill leach pads will be designed to account for the maximum hydraulic load on the liner system.

f) Leach pad, ore heap, and containment dikes shall be analyzed for static and seismic loading conditions.

g) The seismic loading requirements will be established based on site specific conditions.

2. Solution Ponds

Ponds must meet the following minimum requirements:

a) All ponds which are intended to contain process fluids must have a primary synthetic liner and a secondary liner. Between the liners there must be a material which has the ability to rapidly transport any fluids entering it to a collection point which is accessible and has a system for recovering those fluids.

b) When the material between the liners is unable to collect, transport and remove all liquids at a rate that prevents transfer of hydraulic head from the primary to the secondary liner, the pond must be emptied, repaired or reclaimed.

c) Ponds primarily intended to contain overload quantities of process solutions, for a limited time that may result from storm events may be constructed without a direct leak detection system and use a single liner.

d) Ponds containing nonprocess solutions (i.e. make-up water or storm water) may be required to be lined depending on their potential to degrade water quality.

3. Tailings Impoundments

A tailings impoundment must utilize a system of containment equivalent to:

a) Twelve inches of recompacted soil which has an in-place recompacted coefficient of permeability of no more than $1x10^{-6}$ cm/sec; or competent bedrock or other geologic factors underlying the site which has been demonstrated to provide a degree of containment equivalent to the twelve inches of recompacted soil.

b) The liner system may be modified if a detoxification system, e.g., INCO process, is utilized and approved by the RWQCB.

c) Leak detection is required. This may be accomplished by monitoring adjacent to the facility, if approved by the RWQCB.

d) All tailings impoundments will include dewatering systems and seepage collection systems. Preliminary design information required includes lab testing of tailings samples for engineering properties, and consolidation testing to estimate the volume of effluent that will dewater from the consolidation of the tailings mass. This data will be used to design the dewatering collection system. However, lab testing has limited accuracy

estimating actual field conditions. Additional evaluation of in place tailings will be required at closure of the facility (see Reclamation Section C2).

e) Diversion structures must be placed to preclude surface runoff from entering the tailings impoundment during operation. A minimum 100-year, 24-hour storm event design criteria will be utilized for diversion ditches.

f) Groundwater interception structures (french drains, finger drains, geotextiles, etc.) should be considered beneath the impoundment in areas with high or perched water tables or springs.

g) The stability of the tailings impoundments will be analyzed for static and seismic loading conditions. The seismic loading requirements will be established based on site specific conditions.

h) The following should be considered when designing tailings impoundments:

(1) impoundment area and volume of material to be deposited;

(2) embankment type and construction methods;

(3) character of the tailings material to be deposited;

(4) methods used to deposit the impounded material;

(5) character of the site geology;

(6) amount of hydraulic head on the impoundment liner;

(7) extent of recycling and detoxification of impounded solutions;

(8) anticipated operating life of the facility;

(9) individual or cumulative potential effects on the area surface and ground waters.

4. Liners

The performance requirements and design parameters for liner and liner systems will include:

a) When placed on native materials, soil liners must have a minimum thickness of 12 inches and be compacted in lifts which are no more than 6 inches thick. Except when used in tailing impoundments, a soil liner must have a permeability of not more than that exhibited by 12 inches of $1x10^{-7}$ cm/sec material.

b) Synthetic liners must be rated as having a resistance to the passage of process fluids equal to a coefficient of permeability of $1x10^{-11}$ cm/sec.

c) Other information that will be required for consideration when evaluating liner requirements during Notice review or Plan of Operations approval include:

(1) geomembrane installation needs and procedures;

(2) foundation type, slope and suitability;

(3) soil liner particle size distribution, plasticity, porosity, permeability, compaction testing results, and optimum moisture content;

(4) hydraulic loading;

(5) lithostatic loading;

(6) calculated seepage rates;

(7) ore or tailings loading methods and liner protection during loading;

(8) chemical compatibility of liner with contained materials;

(9) exposure and resistance to UV radiation;

(10) depth to groundwater and proximity to surface waters;

(11) ability to transfer seepage to the leak detection system;

(12) potential for liner damage due to subsidence, equipment operation, or ice loading;

(13) manufacturers recommended life of the liner relative to life of the facility.

5. Leach Vats, Tanks, and Processing Plants

Cyanide tanks, vats, or processing plant facilities will be constructed on concrete pads with secondary containment (sills, floor drains, etc.) adequate to contain 110% of the maximum solution content derived from a tank or pipe failure.

Onsite bulk cyanide storage areas must be fenced or enclosed, and secured to prohibit access by unauthorized personnel. Cyanide may not be stored with other incompatible chemicals (i.e. acids).

The operator monitoring program will include sites located adjacent to mixing areas, processing plants, and refineries.

C. Operator Monitoring Plans for Cyanide Facilities

Monitoring by the mine operator is required prior to and during operation, through closure, and after final reclamation. An operator monitoring plan is to be included in the Notice or Plan of Operations. BLM acceptance of the monitoring plan will be part of the review process. Monitoring of cyanide facilities should have special emphasis on water resources. The purpose of the monitoring plan is to: 1) demonstrate and assure compliance with the regulatory requirements; 2) identify potential problems as early as possible; 3) and direct remedial actions should a problem be detected.

Elements to include in the cyanide related monitoring plan are as follows:

1. Groundwater monitoring well locations relative to facility locations and hydrologic conditions. In desert areas depth to groundwater may be 400 to 500 feet. Attenuation and degradation of cyanide occurs through a profile of this depth. Exemptions for situations such as these may be considered, if approved by RWQCB.

2. Groundwater monitoring well design, completion methods, and monitored zone relative to facility locations and hydrologic conditions;

3. Surface water monitoring site locations relative to facility locations and hydrologic conditions;

4. Identification and monitoring plans for any domestic or developed water adjacent to, or immediately downgradient of, the area of operations.

5. A schedule for water quality monitoring which includes:

   a) Sampling frequency, including post-reclamation;

   b) Parameters to be analyzed and methods of analysis;

   c) In-house (operator) analysis versus outside lab analysis;

   d) Quality control procedures;

   e) Reporting schedule;

   f) Threshold levels for remedial action.

6. A sampling schedule with analytical parameters for soils in the land application area(s) is required. This will be designed to monitor metals loading and remaining attenuating capacity.

   The operator is required to report the results from all their cyanide related monitoring programs to the BLM authorized officer as required or immediately if preset threshold levels are exceeded.

D. Spill Contingency

1. Mine Operator

   Any unauthorized spill will be reported immediately to the BLM and appropriate state agencies including RWQCB.

   An operator spill contingency plan is required for all cyanide operations. The plan will describe:

   a) Site topography, facility layout, and prevailing weather conditions;

   b) Agency notification procedures;

   c) Contingency containment procedures;

   d) Equipment lists and location;

e) Location of sensitive areas (domestic water supplies, fisheries, etc.) and specific remedial actions;

f) Neutralization procedures and onsite treatment reagent inventory that will be maintained;

g) Enhanced monitoring procedures;

h) Public notification procedures;

i) Documentation and final incident reporting.

2. BLM Actions

When a spill is reported, BLM will coordinate its activities with State and Federal authorities who conduct onsite investigations of the spill, and monitor the operator's response actions.

For spills that occur when the mine operator is not available, BLM will contact the SMARA lead agency and coordinate its activities with State and Federal agencies who conduct onsite investigations and cleanup actions. The operator and/or the mining claimant will be responsible for any costs incurred by BLM or SMARA agency.

The BLM will verify that the National Response Center (1-800-424-8802) has been notified if cyanide, or other hazardous substances, are released from a cyanide operation exceeding the reportable quantities listed in 40 CFR 302. The reportable quantity for sodium cyanide is ten (10) pounds; this means 10 pounds of cyanide, not 10 pounds of solution.

E. Wildlife Protection

1. General Wildlife

All areas with exposed lethal cyanide solution, including heaps, will be fenced to prevent access by the public, wildlife, and livestock.

All open cyanide solution containment facilities will be inspected by the operator at least weekly for wildlife mortalities. Any mortalities discovered will be reported to BLM within 24 hours. The operator must submit a written report on wildlife mortality numbers, species, and suspected cause to the appropriate State and Federal agency.

2. Migratory Birds

The Migratory Bird Treaty Act states that "...except as permitted by regulation...it should be unlawful at any time by any means or in any manner to...kill...any migratory bird." Based on this, it is the position of the U. S. Fish and Wildlife Service that the only acceptable level of migratory bird mortality is zero.

Migratory bird mortalities associated with cyanide operations have been observed in California. This is due to most mining operations being located in desert terrain, and the lack of open water available for waterfowl. BLM requires a monthly report from all cyanide operators listing the number and type of bird mortalities. A copy of this report is submitted, by the operator, to the U. S. Fish and Wildlife Service. Avian mortalities do occur and these practices will be followed:

Solution containment and transfer structures, including ditches, ponds, and tailings impoundments, which contain levels of cyanide or other leaching agents lethal to migratory birds, will be designed and operated in a manner that prevents access and mortality. Methods of protection proven effective are:

(a) Total enclosure of process solutions;
(b) Treatment of process solutions to sublethal levels (<30 mg/l WAD CN, or to a point where no deaths occur);
(c) Netting of process solution impoundments.

Harassment techniques such as flagging, propane cannons, rock music, etc. have not been proven to be effective.

F. **Temporary Closures**

Temporary closure (includes winter shut-down) of a cyanide operations for a period of longer than 90 days requires the operator to detoxify all process solutions and heaps. This will be waived if the operator provides BLM written notification in advance, maintains adequate monitoring, security, and bonding and has coordinated with and acquired the concurrence of the RWQCB. Planned periods of temporary closure should be addressed in the Notice or Plan of Operations.

V. RECLAMATION STANDARDS FOR CYANIDE OPERATIONS

A. Cyanide Solution (General)

1. All solutions must be reduced to concentration of less than 0.2 mg/l weak acid dissociable (WAD) cyanide prior to discharge except as otherwise approved by the RWQCB.

2. Metal levels must not exceed the applicable state requirements, original background levels, and Maximum Contaminant Levels established under the Safe Drinking Water Act.

3. Acceptable treatment or detoxification methods include, but are not limited to, natural degradation, dilution, oxidation, reverse osmosis, chemical precipitation, cyanide regeneration, or physical transfer of solution to an alternate mining operation.

4. Concurrent reclamation of old process units, in conjunction with active mining, should be used to minimize the leachate inventory present at mine closure.

5. Excess solutions present at closure may be disposed of by:

   a) Recirculation and volume reduction through evaporation;

   b) Physical removal from the mine site;

   c) Cyanide treatment and disposal in the land application area at a rate consistent with the area capacity for metals attenuation;

   d) A combination of the above.

6. Reclamation proposals that require perpetual treatment of effluent discharge from any cyanide facility are not adequate and should be rejected.

B. Leach Pads

This section applies to all types of leach pads: flat, reusable, or valley-fill.

1. Heap leach material will be tested for detoxification efficiency prior to project approval. The results will be used to develop the reclamation plan for heap detoxification to be included in the Notice or Plan of Operations. Factors to be considered when reviewing or developing leach pad detoxification procedures include:

a) Leach pad type;

b) Leach pad geometry, ore depths, and placement methods;

c) Ore composition, chemistry, and acid generating potential;

d) Ore preparation such as crushing and agglomeration;

e) Ore particle size distribution and durability;

f) The heap material physical properties such as bulk density, porosity, permeability, specific retention, tendency for blind-off development, etc.;

g) Chemistry of leaching solution.

2. Detoxification of ore heaps may be accomplished by natural degradation, fresh water rinsing, active treatment procedures such as oxidation, or any combination of these.

3. Spent ore heaps will be detoxified to a sustained level of <0.2 mg/1 WAD cyanide in the heap effluent except as otherwise approved by the RWQCB. The pH levels must be between 6.0 and 9.0. Measurements will be made at the point(s) where the heap discharge waters could/would enter the adjacent environment.

4. Sampling of heap material may be necessary to evaluate residual cyanide, metal, and water content during the reclamation process.

5. Alternate stabilization techniques may be necessary for heaps that are difficult to detoxify and represent a substantial environmental threat, e.g., capping with a low permeable material.

6. Spent ore heaps will be resloped after detoxification. Grades will be sufficient to allow topsoil replacement, vegetation reestablishment, and prevent erosion and exposure of material that may contain residual cyanide. Exact reslope requirements will be evaluated by BLM during specific Plan of Operations approval or Notice review. The minimum slope reduction requirement will be no slopes steeper than 2h:lv. Slopes at 2h:lv will be required to have constructed (non-pioneered) benches every 200 feet of slope length. Detoxified material may be pushed off the liner, if approved by the RWQCB, to achieve the desired slope reduction.

7. After detoxification is complete post-reclamation drainage of the heap material must be provided. This may be accomplished through perforation of the liner material, drilling, or breaching of the containment dike, if approved by the RWQCB. This is necessary to prevent solution build-up within the reclaimed heap that could generate undesirable leachate and/or effect stability.

8. Post-reclamation diversion structures may be necessary around spent ore heaps. At a minimum diversion structures should be sized adequate to prevent runoff from the 100-year, 24-storm event from entering the reclaimed facility.

9. The post-reclamation configuration of heaps will include a collection point adequate for representative monitoring of any leachate that may be generated and discharged to the environment. This collection point will be maintained during the post-reclamation monitoring period (5 year minimum) prior to reclamation bond releases. Variances will be considered upon request where local conditions indicate that the solutions are not an environmental threat.

C. Tailings Impoundments

1. Tailings will be tested to establish dewatering volumes and detoxification efficiency prior to project start-up. The results will be used to develop the reclamation plan for tailings detoxification to be included in the Notice or Plan of Operations.

2. Prior to actual initiation of reclamation activities on tailings impoundments these additional evaluations will be required from the operator to refine the reclamation plan:

   a) Conduct tests of the in-place tailings, at sufficient grid spacing and depth to define the range of impounded tailing material properties;

   b) Determine the degree of consolidation at closure and estimate the amount of ongoing settlement that may result from pore pressure dissipation and primary consolidation;

   c) Estimate the amount of settlement that may occur during long-term secondary consolidation;

d) Estimate the amount of settlement that may result from reclamation cap placement and consolidation;

e) Evaluate the bearing strength of the tailings, reclamation access requirements, and the volume of effluent that will dewater during consolidation;

f) Estimate the depths and volume of reclamation fill that will be required to achieve post-settlement contours.

3. Tailings material is to be dewatered. Effluent derived from dewatering during consolidation will be detoxified to a sustained level of <0.2 mg/l WAD cyanide, except as otherwise approved by RWQCB. The pH levels must be between 6.0 and 9.0. Measurements will be made of the effluent at the point(s) where the impoundment discharge waters could/would enter the adjacent environment.

4. Detoxification of tailings effluent may be accomplished by natural degradation, fresh water rinsing, cyanide recovery, active treatment procedures such as oxidation, or any combination of these. Detoxification during actual tailings deposition may be necessary to achieve reclamation criteria.

5. Sampling of tailings solids may be necessary to evaluate residual cyanide, metal, and water content during the reclamation process.

6. Capping with a low permeability material will be required where tailings are difficult to detoxify or represent a substantial environmental threat.

7. Tailings material will be reshaped after detoxification so as to not collect and pond precipitation. Grades will be sufficient to provide for topsoil placement, vegetation reestablishment, and prevention of erosion with exposure of material that may contain residual cyanide. Exact reslope requirements will be evaluated by BLM during specific Plan of Operations approval or Notice review. The minimum slope reduction requirement will be no slope steeper than 3h:1v. Detoxification material may be pushed off the liner, if approved by the RWQCB, to achieve the desired slope reduction.

8. After detoxification is complete post-reclamation drainage of the tailing material must be provided. This is necessary to prevent solution build-up within the reclaimed impoundment that could generate undesirable leachate and/or affect stability. This may be accomplished through perforation of the liner material by drilling, if approved by the RWQCB.

9. Post-reclamation diversion structures will be constructed around the tailings impoundment. At a minimum, diversion structures will be sized adequate to prevent runoff from the 100-year, 24-hour storm event from entering the reclaimed facility. Depending on the size and hazard potential, post-reclamation diversion structures may be required that can pass up to the Probable Maximum Flood (PMF).

10. The post-reclamation configuration of tailings impoundments will include a collection point adequate for representative monitoring of any leachate that may be generated and discharged to the environment. This collection point will be maintained during the post-reclamation monitoring period in accordance with the monitoring plan approved by the RWQCB (5 year minimum).

D. Solution Ponds

1. Cyanide solution ponds will be drained and the solution detoxified and disposed of in conjunction with overall mine reclamation.

2. Process pond sludge will be tested by the operator to determine if it constitutes a hazardous waste using the TCLP test or other approved methods. If necessary, sludges will be disposed of at a licensed hazardous waste facility in accordance with applicable state laws. If pond sludges are nonhazardous they may be placed on a heap or waste rock dump, if approved by the RWQCB.

3. The pond liner material will be folded, ripped, and buried in the pond area in such a manner as to not impede post-reclamation water movement, or removed to an offsite disposal area unless appropriate secondary uses have been authorized.

4. The pond area will be reshaped to conform with the surrounding topography and in a manner which will not collect surface water flow or precipitation.

E. Vats, Tanks, and Processing Plants

1. These facilities will be detoxified, dismantled, and removed from the site upon completion of mining operations. Onsite burial or disposal of this material is not recommended.

VI. RECLAMATION BONDING

BLM policy requires reclamation bonding of all cyanide facilities administered under a Plan of Operations. The following criteria will be used by BLM when setting reclamation bonds:

1) Notice level operations are not bonded by BLM. In California, a state mining permit and reclamation bond is required by the SMARA lead agency for all cyanide operations. BLM will provide input to SMARA, if requested, in setting the reclamation bond amount for Notice level cyanide operations.

2) For bonding purposes a cyanide facility is defined as any portion of the mining operation where cyanide is transferred, stored, used in processing, or contained in disposed materials. This includes, but is not limited to, ore heaps, mills, mill tailing impoundments, pipelines, storage areas, processing plants, ponds, refineries and waste disposal areas.

3) Bonds are for the purpose of reclamation only and are not for liability or accident insurance.

4) Reclamation bonds will be held for 100% of the cost to reclaim cyanide facilities. This includes the cost for cyanide solution, ore heap, tailings detoxification, and mill dismantling and detoxification.

5) In California, reclamation bonds may be held in conjunction with the RWQCB or the County. BLM will not "double bond" an operator where a state agency holds an adequate reclamation bond. BLM will require a supplemental bond if the state bond is not determined adequate (covers 75% of BLM's reclamation cost estimates).

6) Bond amounts are based on an engineering estimate of the cost to complete the reclamation plan and post-closure monitoring requirements. A 15% charge for administrative costs is added to arrive at the final bond amount. Bond amounts will be reviewed and adjusted periodically (2 years) by the operator, to account for inflation or concurrent reclamation progress.

7) The BLM will, within 30 days of determining that the project is abandoned, initiate bond collection action and begin remediation of process materials or solutions which may pose an imminent threat of environmental discharge and/or contact with humans, wildlife, or livestock. This will be done in cooperation with the appropriate state agencies.

8) A minimum five year period of post-closure monitoring is required for mine waste prior to final reclamation bond release. Release of a reclamation bond does not equate to release of the operator from reclamation liability. Variances will be considered upon request where local conditions indicate that solutions and waste are not an environmental threat and final reclamation is completed to the satisfaction of the Authorized Officer.

VII. INSPECTION AND ENFORCEMENT

Field inspections are conducted to ensure that operators comply with state and federal regulations and their Notice or approved Plan of Operations. Inspection and enforcement of cyanide operations will follow these general guidelines:

A. Inspections

All operations using cyanide are to be inspected by BLM at least once every three (3) months. Inspections may be conducted jointly with SMARA, or other state agencies, when possible. Inspections will be performed by personnel with technical expertise applicable to the mines operational stage, or particular resource concern being evaluated.

Copies of the inspection report will be sent to the operator and the SMARA lead agency with the original to the BLM case file.

Results from the operator's monitoring programs will be utilized to target inspection areas or frequencies.

Inspection of cyanide operating will include, but not be limited to, an evaluation of the following:

1) Construction procedures;

2) Freeboard available for the prescribed precipitation event;

3) Wildlife exclosures;

4) Wildlife mortalities;

5) Public access restrictions;

6) Location and storage facilities for cyanide and other reagents;

7) Overspray of cyanide solution from heaps on unlined surfaces;

8) Cyanidated material placed on an unlined surface;

9) Evidence of unstable heap or tailings slopes;

10) Run-on/run-off diversion structures;

11) Apparent leakage from solution collection or transfer structures;

12) Leak detection and recovery systems;

13) Monitoring well locations.

BLM inspectors may take samples from monitoring sites, the process circuit, or at any location/time they deem it necessary to determine operator compliance.

BLM inspectors may sample surface and groundwater at key monitoring points downgradient of cyanide facilities at least twice a year to verify the operator monitoring program results.

Sampling will also be used when necessary to investigate undesirable events or complaints.

Sampling may be accomplished using presumptive field test kits, laboratory samples, or both (noncompliance actions should be based on lab samples rather than field test kits). Samples will be collected by trained personnel using standard practices and techniques. All sample results will be included in the BLM inspection reports.

B. Enforcement

Enforcement actions are taken when an operation is determined to be in noncompliance with the existing Notice, approved Plan of Operations, or other regulatory requirement. Upon determining that noncompliance exists, the operator/claimant is requested to take corrective action. However, if the noncompliance persists, a Notice of Noncompliance (NON) is issued. The main purpose of a NON is to put the operator on notice that they are out of

compliance and to direct corrective action. Civil or criminal penalties may be assessed if noncompliance results in violation of state or federal laws. Some specific causes for issuing a NON related to cyanide operation are as follows:

1. The release or placement of cyanidated solution or material outside the approved process circuit;

2. Failure to incorporate and maintain protective measures which prevent wildlife mortality;

3. Failure to implement the operational monitoring programs;

4. Failure to comply with state or other federal regulation. This action will include reference to the appropriate agency.

VIII. NEPA ANALYSIS AND LAND USE PLANNING

A. NEPA Analysis

The approval of a Plan of Operations or amendment to an existing Plan of Operations constitutes a federal action and is subject to NEPA. A Notice is not a federal action and no NEPA documentation is required. Detailed guidance on the NEPA process is in the BLM Handbook H-1790-1, and stated in regulations 40 CFR 1505.

Factors of NEPA analysis specific to a cyanide operation include:

1. The analysis will evaluate the "No Action" alternative;

2. The analysis will not evaluate alternate leaching agents or processing technologies;

3. The analysis may consider alternate facility site alternatives;

4. The analysis will evaluate cyanide transport and storage;

5. BLM will use the NEPA document to develop and evaluate any additional mitigating measures needed to prevent environmental degradation caused by cyanide operations.

B. **Land Use Planning**

Detailed guidance on locatable mineral resources input to land use planning is contained in BLM Manual 1624.

A cyanide operation Notice or Plan of Operations may be received and processed at any time before, after, or during resource management plan (RMP) preparation.

When a RMP/EIS is prepared it includes an analysis of cumulative impacts that are reasonably foreseeable. The possibility for development or expansion of cyanide operations is assessed in the RMP based upon the mineral resource potential of the planning area. General management determinations are then made in the RMP to guide the location and operation of cyanide facilities. Detailed environmental analysis of a specific cyanide operation proposal are not conducted in an RMP.

IX. RESEARCH AND DEVELOPMENT

BLM encourages testing and research projects to identify and evaluate best management practices for reclamation and resource protection. Such projects will be conducted in cooperation with industry and other state or federal agencies.

The use of new technologies or unproven practices must include a fall back mitigation plan in the event that problems or failure occur.

X. TRAINING

BLM personnel whose primary duties involve the review and/or inspection of cyanide operations should take the following courses as soon as possible.

A. Sodium cyanide first aid (conducted by MSHA).

B. A basic cyanide course similar to the Society of Mining Engineers short course - Evaluation, Design, and Operation of Precious Metal Heap Leach Projects. (This same course is often contracted by BLM or FS for in-house training).

The following courses are listed references for continuing training by BLM inspectors.

A. BLM course 3000-23, Locatable Minerals Surface Management.

B. BLM course 3000-48, Locatable Minerals Inspection and Enforcement.

C. BLM course 3000-49, Reclamation for Locatable Minerals.

D. BLM course 7000-01, Water Quality Data Acquisition, Analysis, and Interpretation.

XI. SOLID AND HAZARDOUS MATERIALS

No hazardous waste may be disposed of onsite. Presently mine waste is not considered hazardous waste regulated under Subtitle C of RCRA.

EPA is currently developing regulations (Strawman II) proposing to regulate mine waste as a solid waste under Subtitle D of RCRA.

Cyanide maybe considered hazardous waste if found abandoned and not associated with any known operation.

Process pond sludges may be considered hazardous wastes. Sludges that accumulate in process ponds are to be tested by the operator to see if they classify as a hazardous waste and disposed of accordingly.

XII. SAFETY

A. PUBLIC

Cyanide operations will be closed to general public access. Public access restrictions will be incorporated into the Notice or Plan of Operations.

Warning signs will be posted near any open cyanide containment areas.

B. BLM Employees

All BLM employees that perform inspection duties will have received the MSHA sodium cyanide first aid training course or equivalent training and the Mine Safety training course.

All BLM inspectors will be aware of the location of first aid kits.

XIII. GLOSSARY OF TERMS AND DEFINITIONS

BASELINE DATA: Resource data on soils, vegetation, hydrology, wildlife, geology, etc. collected prior to disturbance that establishes existing environmental conditions. The duration and extent of baseline data requirements is determined on a site specific basis.

CYANIDE FACILITY: A discrete portion of the mining operation where cyanide is used, transferred, or stored. (eg. leach pad, leach tanks, cyanide pond, tailings impoundments, processing plant, pipelines, etc.)

CYANIDE OPERATION: A mining operation that uses cyanide in its process circuit.

DETOXIFICATION: Reduction of cyanide or other constituents to concentrations that are not acutely toxic to anticipated receptors, or to the levels required by regulatory agencies.

DOUBLE LINER SYSTEM: A liner system composed of two synthetic liners; or a liner system composed of one synthetic liner over one compacted soil liner, sometimes called a composite liner.

FOS: Factor of Safety: A ratio of the forces resisting failure over the forces promoting failure. A FOS of 1 means the forces are equal. FOS greater than 1 imply stability under the conditions analyzed.

LEACHATE: Liquid that has percolated through a material. A solution obtained by leaching.

MAXIMUM CONTAMINANT LEVEL: The water quality levels for various constituents established by the Safe Drinking Water Act to protect drinking water supplies. MCLs for some contaminants that could be associated with cyanide operations are:

Arsenic	0.05 mg/l	Barium	1.0 mg/l
Cadmium	0.01	Chromium	0.05
Nitrate	10.0 (NO_3 as N)	Lead	0.05
Mercury	0.002	Selenium	0.01
Silver	0.05	Fluoride	2.4

mg/l: Milligrams per liter. Approximately equal to parts per million for solutions with a density equal to water.

NEUTRALIZATION: Any of a variety of processes used to achieve detoxification. May include natural degradation, chemical treatments, or dilution.

NOTICE LEVEL OPERATION: An operation that disturbs less than five acres and occurs outside a special management area.

pH: A measure of acidity or alkalinity. A pH of 7 is neutral, lower numbers are acidic, and higher numbers are alkaline.

PMF: The Probable Maximum Flood which may be expected from the most severe combination of meteorologic and hydrologic conditions reasonably possible in the region.

PMP: The Probable Maximum Precipitation which may be expected from the most severe combination of meteorological and terrain factors reasonably possible in the region. Generates the PMF. Is often on the order of five (5) times greater than the 100-year return period precipitation event.

QUALITY ASSURANCE: A planned system of inspections performed by the operator's contractor to control the quality of construction/installation.

QUALITY CONTROL: A planned system of activities performed by the operator to assure that the facility is constructed as specified in the design.

SLUDGE: Material or sediment that collects in the bottom of process ponds. Often consists of diatomaceous earth used in the process plant, fines derived from the ore, and metal precipitates.

SPILL: Unauthorized cyanide discharge beyond the containment area. The reportable quantity for sodium cyanide is ten (10) pounds; this means 10 pounds of cyanide not 10 pounds of solution.

TAILINGS: Crushed or ground rock particles that are either produced or deposited in a slurry form. Often consists of diatomaceous earth used in the process plant, fines derived from the ore, and metal precipitates.

WAD CYANIDE: Weak acid dissociable cyanide. Includes cyanide that exists as CN^-, HCN, plus weak metal-cyanide complexes.

XIV. SELECTED REFERENCES AND FURTHER READINGS:

British Columbia Acid Mine Drainage Task Force, 1989, Draft Acid Rock Drainage Technical Guide, Volumes 1 and 2. Crown Publications, Victoria, B.C.

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Mudder, T.I., (ed.) 1989, The Chemistry, Analysis, Toxicity and Treatment of Cyanidation Wastewaters. SME Shortcourse Notes, AIME National Meeting, Las Vegas, Nevada, February, 1989.

National Park Service, U.S. Department of the Interior, 1986, Environmental Handbook for Cyanide Leaching Projects: NPS, Energy, Mining, and Minerals Division.

Schafer & Associates, and EIC Corporation, 1991, Cyanide Degradation and Rinsing Behavior in Landusky Heaps, Final Report, January 22, 1991: BLM case file MTM-77779, Lewiston District Office.

Van Zyl, D.J.A., ed., 1987, Geotechnical Aspects Of Heap Leach Design. SME-AIME, Littleton, Colorado.

Van Zyl, D.J.A., Hutchinson, Ian P., and Kiel, Jean E., editors, 1988, Introduction to Evaluation, Design and Operation of Precious Metal Heap Leaching Projects: SME-AIME, Littleton, Colorado.

Van Zyl, D.J.A., 1991, The Design of Reliable Heap Leach Pad and Pond Liners: Heap and Dump Leaching, Vol. 6, Number 1, April, 1991

Vick, Steven G., 1983, Planning, Design, and Analysis of Tailings Dams: John Wiley & Sons Publications. 369 pp.

TABLE I

OPERATING MINES

MINE	LOCATION	PRODUCTION Troy Ounce
Billiton Billiton/Standard Hill	Ridgecrest Resource Area (619) 375-7125 2 miles south of Mojave on Silver Queen Road off Highway 14 in Kern County.	9,000
Cactus Coca Mines, Inc.	Ridgecrest Resource Area (619) 375-7125 5 miles west of Highway 14 on Bacus Road at the intersection of Bacus Road and Tehachapi Willow Spring Road in Kern County.	58,000
Carson Hill Carson Hill Mining Corp.	Folsom Resource Area (916) 985-4474 6 miles west of Sonora off Highway 49 in Calavaras County.	5,000
Hog Ranch Western Mining Corp.	Surprise Resource (NV) (916) 279-6101 50 miles east of Cedarville off Nevada Highway 34 (gravel road) in Washoe County.	30,000
Mesquite/VCR Gold Field Mining Corp.	El Centro Resource Area (619) 352-5842 34 miles east of Brawley off Highway 78 in Imperial County.	200,000

TABLE I - OPERATING MINES (continued)

MINE	LOCATION	PRODUCTION Troy Ounce
Morning Star Vanderbilt Mining Corp.	Needles Resource Area (619) 326-3896 10 miles southeast of Mountain Pass on the east slope of the Ivanpah Mountains in San Bernardino County; from Las Vegas take Interstate 5.	10,000
American Girl American Girl Mining Corp.	El Centro Resource Area (619) 352-5842 14 miles northwest of Yuma, AZ off Interstate 8 and Ogilby Road in Imperial County.	47,000
Snow Caps Sunshine Mining Corp.	Bishop Resource Area (619) 871-4881 5 miles east of Independence off Highway 395 in Inyo County.	0
Lamont Rand Mining Corp.	Ridgecrest Resource Area (619) 375-7125 2 miles southwest of Randsburg off Highway 395 and the Randsburg exit in Kern County.	25,000
McLaughlin Homestake Mine	Redding Resource Area (916) 246-5325 14 miles Southeast of Lower Lake in Lake County.	230,000
Bond Gold Colosseum Colosseum Mine	Needles Resources Area (916) 326-3896 40 miles east of Baker	70,000

TABLE I - OPERATING MINES (continued)

Castle Mountain Venture Viceroy Gold Corporation	Needles Resource Area 40 miles east of Baker near the California/Nevada border in eastern San Bernardino County south of the Nipton turnoff.	(619) 326-3896	(Start-Up)

TABLE II

MINES IN PERMITTING STAGE

MINE	LOCATION
Padre Madre American Girl Mining Corp.	El Centro Resource Area (619) 352-5842 14 miles northwest of Yuma, AZ off Interstate 8 and Ogilby Road in the Cargo Muchacho Mountains in Imperial County.
Hayden Hill Amax Gold	Alturas Resource Area (916) 233-4666 Lassen County, California 54 road miles north of Susanville

TABLE III

CYANIDE QUALITY CRITERIA

WATER QUALITY STANDARDS

Standard	Concentration[A] (mg/l)	Duration	Frequency	Ref
Freshwater-Chronic	0.0052	4 day	once/3 years	1
Freshwater-Acute	0.022	1 hour	once/3 years	1
Drinking Water Advisory	0.200	-	-	1

CHRONIC DOSE-RESPONSE DATA

Receptor	Effect	Dosage	Equivalent[A]	Ref
Humans	non-toxic dose	10 mg/day	5 mg/l[B]	6
Humans	no observed effect	5 mg/day	2.5 mg/l[B]	6
Humans	non-injurious	< 10% of drinking water std.	2.0 mg/l	2
Chickens	non-toxic	6 mg/kg	34 mg/l[C]	8

ACUTE DOSE-RESPONSE

Receptor	Effect	Dosage	Equivalent[A] Concentration	Ref
Humans	LD_{50}	1 to 3 mg/kg	35 to 105 mg/l[B]	3
Mice	LD_{50}	3 mg/kg	105 mg/l[D]	3
Birds	LD_{50}	0.1 mg/kg	3.5 mg/l[D]	4
Cattle	LD_{50}	.9 mg/kghr	315 mg/l[D]	7
Chickens	LD_{50}	21 mg/kg	120 mg/l[C]	8
Bluegill	LC_{50}	-	0.126 mg/l	5
Perch	LC_{50}	-	0.107 mg/l	5

Footnotes to Table III

A - Concentrations are based on free cyanide levels. EPA suggests use of total cyanide, however, due to lack of an acceptable method for free cyanide determination.
B - Based on 2 liters of water consumption. 50 to 70 kg adult.
C - Based on a 2 kg adult weight and 0.35 l water consumption.
D - Assuming an equivalent water consumption.
E - Assuming water intake equivalent to humans over a 10 hour waking period and a 250 kg adult weight.

References

1 - EPA 440/5-86-001, 1986
2 - Canadian Water Quality Guide, 1987
3 - Gosselin and Gleason, 1976
4 - DiPalma, 1971
5 - IMS, 1986
6 - VanZyl et al. (Eds.), 1984
7 - Mudder et al., 1989